

S.B.T.

Highway Safety Literature

... A SEMI-MONTHLY ABSTRACT JOURNAL

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NHTSA: National Highway Traffic Safety Administration, General Services Division, Washington, D.C. 20590. **Give HS-No.**

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. **Order by title and SAE report numbers.** Prices given are list; discounts are available to SAE members and sometimes to libraries and U.S. Government Agencies. Prepayment is required; orders received without payment are subject to a \$1 handling charge.

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Material directly related to Highway and/or Motor Vehicle Safety is solicited for inclusion in Highway Safety Literature. Topics must fall within the scope of the Subject Fields and Groups listed on the inside front cover. Submit material, together with a written statement of approval for publication to:

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Safety Administration
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Subject Categories
 NHTSA
 Accession No. HS-800 218 Fld. 5/21; 5/9
 Title of document AN INVESTIGATION OF USED CAR SAFETY STANDARDS—SAFETY INDEX: FINAL REPORT. VOL. 6 — APPENDICES G-L
 Personal author(s) by E. N. Wells; J. P. Fitzmaurice; C. E. Williams; S. R. Kalin; P. D. Williams
 Corporate author Operations Research, Inc.
 Pagination
 Publication date 1969 150p
 Contract FH-11-6921 Report no. ORI-TR-553-Vol. 6; PB-190 523
 Abstract Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks.
 Search terms: Wear; Trucks; Failures; Used cars; Inspection standards
 Availability NTIS

HS-004 497 Fld. 5/19

AUTO THEFT—THE PROBLEM AND THE CHALLENGE

by Thomas A. Williams, Sr.

Journal citation Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec. 1968)

Gives figures on the extent of the auto theft problem and comments on anti-theft devices available now or in the planning stage.

Search terms: Theft; Theft protection; Stolen cars

(Note: If the date of a report or Journal article is not given, the small letters nd will appear)

NOTE: () Numbers in parentheses following certain subject groups indicate the Highway Safety Program Standards (No. 1 and up) and/or Federal Motor Vehicle Safety Standards (No. 101 and up) which may apply to these groups.

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5/0 VEHICLE SAFETY 12

*All Federal Motor Vehicle Safety Standards apply to passenger vehicles. An asterisk before a subject group indicates additional types of vehicles to which the indicated standards may apply.

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HS-011 994 Fld. 1/2; 5/14

SEVERE FRONTAL COLLISIONS AND RESULTING INJURIES WITH AND WITHOUT RESTRAINING DEVICES

by W. Lange

Max-Planck-Inst. für Arbeitsphysiologie
(West Germany)Published in *AGARD Conference Proceedings n88* (AGARD-CP-88-71) 1971
pC5-(1-10)

7refs

Presented at the Aerospace Medical Panel Specialist Meeting, AGARD Conference on Linear Acceleration of Impact Type, Oporto, Portugal, 23-26 Jun 1971.

This paper briefly describes the results of simulated frontal collisions. Types and magnitudes of injuries sustained by cadavers depend on whether or not they were restrained by safety belts; type and stiffness of belts; absence or presence of steering assembly and instrument panel; and interactions between body, harness and structures in the driver's space. Two pilot studies with air bags yielded conflicting results.

Search terms: Head on impact tests; Accident simulation; Cadavers in testing; Injury severity; Impact sleds; Acceleration; Instrument panel caused injuries; Steering wheel caused injuries; Chest injuries; Three point restraint systems; Air bag restraint systems; Restraint system tests; Impact caused injuries

HS-012 030 Fld. 1/2; 4/7

THE BIODYNAMICS OF AIR BLAST

by C. S. White; R. K. Jones; E. G. Damon; E. R. Fletcher; D. R. Richmond

Published in *AGARD Conference Proceedings n88* (AGARD-CP-88-71) 1971
p14-(1-21)

96 refs

Presented at the Aerospace Medical Panel Specialist Meeting, AGARD Conference on Linear Acceleration of Impact Type, Oporto, Portugal, 23-26 Jun 1971. Supported by the Defense Atomic Support Agency and the Atomic Energy Commission.

After pointing out accelerative and decelerative events associated with the direct and indirect effects of exposure to blast-induced winds and pressure variations, some of the relevant biophysical parameters are discussed. These include the pressure-time relationship; species differences; ambient pressure effects; the significance of positional and geometric factors as they influence the wave form, the pressure dose and the biologic response; and data bearing upon the etiology of blast injury. The consequences of pressure-induced violent implosion of the body wall and the significance of the associated variations in the internal gas and fluid pressures are described and emphasized as are alternating phases of forced hemorrhage and arterial air embolization, fibrin thrombi, coagulation anomalies, and renal, cardiac, and pulmonary sequelae. Tentative biomedical criteria consistent with recent interspecies scaling and modeling studies for assessing primary blast hazards are presented.

Search terms: Airblast; Blast injuries; Pressure responses; Animal experiments; Animal acceleration tolerances; Animal deceleration tolerances; Embolism; Hemorrhage; Mathematical models; Chest acceleration tolerances; Injury research; Pressure time histories; Pressure waves; Accident survivability; Abdominal impact tolerances; Biophysics; Biodynamics; Parameters

HS-012 031 Fld. 1/2; 3/2

THE DYNAMIC BIOMECHANICAL NATURE OF SPINAL FRACTURES

by L. E. Kazarian; D. D. Boyd; H. E. von Gierke

Aerospace Medical Res. Lab. (6570th)

Published in *AGARD Conference Proceedings n88* (AGARD-CP-88-71) 1971
p19-(1-25)

20refs

Report no. AMRL-TR-71-17

Presented at the Aerospace Medical Panel Specialist Meeting, AGARD Conference on Linear Acceleration of Impact Type, Oporto, Portugal, 23-26 Jun 1971.

Animal experiments are shown to be of value to explain hard tissue injury mechanisms and individual organ injury potential in man exposed to impact forces. Rhesus monkeys were anesthetized, radiographed, positioned in an impact carriage, restrained by lap belt, torso harness, and limb retention straps, and exposed to +Gz seated rectangular acceleration time histories from predetermined drop heights. Following impact all primates were radiographed, killed, and a necropsy performed. Attempts were made to determine injury potential as a function of plateau acceleration and pulse duration for the spinal column. Type, frequency, and severity of vertebral body centrum fractures along with injury to the vertebral appendages were classified. Injury probabilities for the vertebral column established by radiographic and gross necropsy examination supplement and explain available knowledge on spinal injury mechanisms observed in the rhesus monkey. Applicability of these data to man is discussed.

Search terms: Animal experiments; Monkeys; Animal impact tolerances; Injury severity; Injury research; Spinal impact tolerances; Injury probability; Animal acceleration tolerances; Autopsies; Spinal fractures; Biomechanics; Acceleration response

HS-012 020 Fld. 1/3; 5/22; 2/7

**INFLUENCE OF VEHICLE AND
PAVEMENT FACTORS ON WET-
PAVEMENT ACCIDENTS**by K. D. Hankins; R. B. Morgan; B
Ashkar; P. R. TuttPublished in *Highway Research Record*
n376 p66-84 (1971)

7refs

Sponsored by Highway Research
Board Steering Committee for Work-
shop on Anti-Skid Program Manage-
ment.

Five variables believed to be closely associated with the friction available at the tire-pavement interface were analyzed by studying 501 wet-weather vehicular accidents. Tire pressures and tread depths were obtained from the accident vehicles, vehicular speed from the investigating officer's report, and friction and macrotexture from the pavement surface at the accident site. It was concluded that the lack of pavement texture, low pavement friction, high vehicle speed, worn tires, and large vehicle tire pressures all contribute to accidents occurring on wet pavement. The accidents were also categorized into several types, and it was found that the variables are even more significant for certain accident types. Studies should be directed toward cornering friction because some 40% of the accidents involved a turning maneuver.

Search terms: Accident analysis; Wet road conditions; Tire inflation pressure; Tire pavement interface; Tire tread depths; Speed; Pavement surface texture; Texas; Accident investigation; Cornering; Skid resistance tests; Skidding accidents; Accident types; Variance analysis; Accident studies; Accident factors

HS-012 056 Fld. 1/3; 4/5

Communications and Systems, Inc.

1969 146p
Report no. C&S-70-472Sponsored by New Jersey Dept. of
Transp. and National Hwy. Safety
Bureau.

The major objective of this study is to develop detailed constructive recommendations for an improved highway accident reporting system with emphasis on the following aspects of system design and operation: reduction in the delay in entering accident information into the accident statistics data file; improvements in the dissemination of all required information to all users of the system; and compliance with the National Highway Safety Program Standards 4.4.9 (Identification and Surveillance of Accident Locations) and 4.4.10 (Traffic Records). Changes required to overcome the major deficiencies of the present system related to the treatment of existing backlogs; inputting and encoding of data; identification of hazardous locations; and dissemination of data.

Search terms: New Jersey; Accident reports; Accident statistics; Data acquisition; Accident location; Accident surveillance; Police reports; Data analysis; Highway safety standards; Accident report forms; Automated accident records; Safety standards compliance; Coding systems; Information system design; Flow charts; Driver records; Data transmission

HS-600 861 Fld. 1/3; 1/5

**SUMMARY OF 1968-1970 MUL-
TIDISCIPLINARY ACCIDENT IN-
VESTIGATION REPORTS. VOL.
2**National Hwy. Traf. Safety Administra-
tion

This volume contains aggregations of all the factors listed from the 448 individual reports in vol. 1. These aggregations are listed according to the matrix cell they are categorized under, major topic areas under these matrix cells, and the team and case number of occurrence in which the particular aggregated factors appear. Section 1 gives a brief background of the teams, a description of their accident case selections, the matrix classifications, the purpose and utilization, and a discussion of significant trends. Section 2 contains the aggregated factors (2206) according to matrix cell, major topic area, and the team and case number in which they occurred.

Search terms: Multidisciplinary teams; Accident investigation; Accident case reports; Accidents by vehicle age; Accident statistics; Accident factors; Fatalities; Injury factors; Precrash phase; Crash phase; Postcrash phase; Human Factors; Environmental factors; Defective vehicles; Accident causes; Accidents by vehicle make; Driver error caused accidents; Failure caused accidents; Accident types; Accident severity; Pedestrian accidents

AVAILABILITY: NTIS

1/5 Statistical data

HS-012 005 Fld. 1/5; 5/10; 5/3

**EFFECT OF DAYTIME MOTOR-
CYCLE HEADLIGHT LAWS ON
MOTORCYCLE ACCIDENTS**

by M. S. Janoff; A. Cassel

Published in *Highway Research Record*
n377 p53-63 (1971)

15refs

Sponsored by the Highway Research Board Committee on Visibility and presented at the 50th annual meeting.

This paper describes the results of an analysis of the motorcycle accident records of four states with daytime motorcycle headlight laws—Indiana, Montana, Oregon, and Wisconsin—and of four control states. Total daylight motorcycle accidents in the four states with daytime headlight laws were reduced 41.3%; nighttime accidents were reduced 37.5%. This difference of 3.8%, which indicates the effect of daylight headlamp operation, is significant at the 0.1 level. If the 3.8% figure is applied to the total daytime motorcycle accident involvements in the United States, a reduction of 7,140 can be achieved. If daytime motorcycle headlight laws were adopted on a nationwide basis, the total yearly savings in reduced motorcycle accident involvements would be approximately \$15.7 million to \$22.8 million, or approximately \$7.50 to \$10.90 per motorcycle per year.

Search terms: Motorcycle accidents; Headlamp daytime usage; Motorcycle laws; Day vs night accident risks; Accident rates; Motorcycle visibility; Accident prevention; Accident analysis; Indiana; Montana; Oregon; Wisconsin; Vehicle motorcycle collisions; Accident costs; Accident statistics; Light conditions

HS-012 039 Fld. 1/5

TRAFFIC ACCIDENT FACTS 1971

Philadelphia Dept. of Streets

1972 38p

Traffic accidents in Philadelphia resumed their upward trend in 1971, mounting to 58,411, a 4% increase over 1970. This increase was in line with the 1971 growth in motor vehicle registration in Philadelphia and an equivalent increase in vehicle miles travelled. Motor vehicle

was similar to the national trend. The accident record analysis includes driver involvement and fatality rate, deaths and injuries, economic loss, 1971 vs 1970 comparison, pedestrian record, the driver, physical hazards, traffic safety indoctrination, and accident prevention activities. Detailed charts and graphs of accident statistics supplement the text.

Search terms: Philadelphia; Accident statistics; Accident rates; Traffic accidents; Accident analysis; Accident causes; Accident types; Time of accidents; Age factor in accidents; Sex factor in accidents; Fatality rates; Injury rates; Accident costs; Pedestrian accidents; Accident risks; Accident location; Safety education; Light conditions; Accident prevention; Month; Day of week

2/0 HIGHWAY SAFETY

HS-011 997 Fld. 2/0; 4/2; 1/5

STATE OF WASHINGTON HIGHWAY SAFETY PROGRAM

Washington Traf. Safety Commission

1969 347p 140refs

Prepared with the assistance of Wilbur Smith and Associates.

This document evaluates and reports on the status of highway safety program activities at the state and local levels with respect to the 16 national highway safety standards. It outlines program needs, establishes an initial priority schedule, and sets forth a proposed implementation schedule. The program is designed to provide the guidelines for development of a total statewide program of a scope beyond the minimum requirements established by the National Highway Safety Standards. The complete text of the Highway Safety Act of 1966 and the basic requirements of the 16 federal highway safety standards are

Accident statistics; Debris removal; Highway Safety Act of 1966; Driver licensing; Traffic laws; Driver education; Traffic courts; Vehicle inspection; Safety standards compliance; Washington (State); Vehicle registration; Motorcycle safety; Pedestrian safety; Drinking drivers; Safety standards costs; Accident location; Highway design; Traffic records; Emergency medical services; Highway construction; Highway maintenance; Traffic control devices; Accident costs; Police traffic services; Priorities

HS-012 013 Fld. 2/0

ESTIMATE OF THE COST OF CARRYING OUT THE PROVISIONS OF THE HIGHWAY SAFETY ACT OF 1966. A REPORT TO THE CONGRESS FROM THE SECRETARY OF TRANSPORTATION

Dept. of Transp.

1968 121p 6refs

This report contains detailed cost estimates developed primarily by the states and communities based on broad guidelines prepared by the National Highway Safety Bureau. Major findings in the report with respect to the state programs include the following: total annual needs for state and local highway safety programs, as estimated by the states, are \$2.5 billion in 1968 and will grow to \$4.5 billion by 1976; state and local governments spent \$1.9 billion in 1967 on highway safety and are expected to continue providing more than 50% of safety program needs over the next ten years. Each of the highway safety standards is discussed in terms of needs and costs, and the research and development needs are outlined.

1/5 Statistical data (Cont'd.)

HS-012 013 (Cont'd.)

Traffic courts; Drinking drivers; Accident location; Driver licensing; Federal state relationships; State action; Traffic records; Emergency medical services; Highway design; Highway construction; Highway maintenance; Traffic control devices; Pedestrian safety; Police traffic services; Debris removal; Economic analysis; Highway safety standards; Safety research

HS-810 239 Fld. 2/0

REMARKS AT THE MIDWEST REGION FIELD SERVICE REPRESENTATIVES AND "STATES" ORGANIZATIONS MEETING, ST. LOUIS, MISSOURI, OCTOBER 4, 1972

by C. H. Hartman

National Hwy. Traf. Safety Administration

1972 17p

A proposal is made to consolidate and revise the 16 highway safety standards which were promulgated in 1967 into a new grouping of eight: program administration, traffic records, and evaluation; traffic laws and regulations; vehicle requirements; traffic safety education; driver licensing; police traffic services; traffic courts and adjudication systems; and emergency medical services. The functions and features of each are described. The present status of the Comprehensive Highway Safety Program is described as well as the report card to measure the progress of individual states in implementing the standards.

Search terms: Highway safety standards; Traffic records; Traffic laws; Driver education standards; Driver license standards; Police traffic services; Traffic courts; Emergency medical services; Highway safety programs;

Safety systems; Compliance; Program evaluation; Federal state relationships; Safety education

AVAILABILITY: NHTSA

2/1 Breakaway Structures

HS-012 035 Fld. 2/1

REPORT OF IMPACT TESTS ON LIGHTING POLES

by C. J. Hart

National Electrical Manufacturers Assoc.

1969 41p

The breakaway characteristics of 12 luminaire supports were determined. Impact tests were performed on poles of various thicknesses and mounting heights and made of different aluminum alloys. The results of the tests including initial and final velocity of the pendulum, change in momentum, maximum deceleration, time duration of impact, and breakaway energy are presented. In all cases, the transformer base decreased the breakaway energy of the particular pole which is supported—despite higher maximum deceleration values. The decrease in energy is due to an almost instantaneous fracture—8 to 16 millisecon. duration—of the transformer base. This time contrasts with the approximate 50 millisecon. impact time for the shoe base mounted post.

Search terms: Breakaway light poles; Pole impact tests; Pendulum tests; Impact velocity; Deceleration; Test equipment; Aluminum alloys; Materials tests; Time factors; Breaking energy

2/4 Design and Construction

HS-011 996 Fld. 2/4

CALIFORNIA STREET AND HIGHWAY CONFERENCE (15TH) PROCEEDINGS, PRESENTED AT

THE UNIVERSITY OF CALIFORNIA AT LOS ANGELES, JANUARY 24-26, 1963

California Univ. ITTE

202p

Papers on highway policy and planning discuss legislation, trends, underemphasized future needs, and urban mass rapid transit. Engineering administration and management papers discuss government decision making, human aspects, public relations, scheduling in the construction industry, assessment district pavement maintenance planning, arterial street and highway standards. Traffic engineering and safety considerations include signs, signals, and markings; traffic signals near railroad crossings; and upgrading street capacity. Papers on materials include new paving products, epoxy resins for structural repair, aggregates, nuclear devices for determination of soil moisture and density, specification compliance in highway projects, corrosive soil conditions, and material control in smaller cities and counties. Research papers discuss national trends, the AASHO program and road test, and motor vehicle noise.

Search terms: Highway standards; Highway planning; California; Highway management; Highway engineering; Traffic engineering; Highway construction; Road materials; Vehicle noise; Financing; Traffic signals; Traffic signs; Decision making; Urban transportation; Rapid transit systems; Public relations; Scheduling; Highway maintenance; Traffic control devices; Uniformity; Federal role; State government; Aggregates; Radioactive materials; Soil tests; Local government; Highway research

HS-012 017 Fld. 2/4

SAFETY AT THE ROADSIDE

by R. A. Wilson

General Motors Proving Ground

Presented at the Ontario Traffic Conference, Windsor, Ontario, 16 May 1972.

improvements made at the GM Proving Ground to eliminate or de-lethalize roadside obstacles are discussed. The majority of accidents at the proving ground were run-off-the road accidents. In the x years immediately before roadside clearance and improvements, 64 days of injury time were sustained in proving ground damage accidents involving test drivers. Between 1958 and 1964, the six years immediately following these improvements, there was not a single lost time injury accident on the improved roads. Roads with clear, negotiable right-of-way for vehicle recovery along either side, traversable slopes, effective guardrails, safer lamp and sign post mountings, and deflecting bridge parapets can result in less injuries and fewer lost lives.

Search terms: Roadside hazards; Highway improvements; Highway design; Guardrail design; Bridge parapet design; Breakaway structures; Sign impact protection; Injury prevention; Proving grounds; Ran off road accidents; Fixed objects; Safety design

HS-012 018 Fld. 2/4; 5/9

SAFETY INSPECTION OF THE HIGHWAY AND THE VEHICLE

y W. A. Goodwin

Published in *Highway Research Record* 3376 p21-8 (1971)

3refs

Sponsored by the Highway Research Board Steering Committee for Workshop an Anti-Skid Program Management and presented at the workshop.

It is believed that the number of skidding accidents is great enough to warrant continued study. In this regard, the in-

formation of pavement characteristics, as well as an inventory of pavements as to their level of skid resistance, must be undertaken by each state. Also, it is of great importance that the periodic motor vehicle inspection program be reviewed in context with the objectives of the anti-skid programs to achieve and maintain an appropriate relationship between the two efforts. An anti-skid program is needed in each state as part of the highway safety total effort.

Search terms: Highway safety programs; Highway safety standards; Pavement skid resistance; Skid resistance tests; Measuring instruments; Vehicle inspection; Inspection procedures; Inspection standards; Automobile defects; State action; Stopping distance; Pavement skidding characteristics; Tire inspection; Defective tires

HS-012 021 Fld. 2/4; 5/22

COMPARISON OF HIGHWAY PAVEMENT FRICTION MEASUREMENTS TAKEN IN THE CORNERING-SLIP AND SKID MODES

by B. M. Galloway; J. G. Rose

Published in *Highway Research Record* n376 p107-22 (1971)

20refs

Sponsored by Committee on Surface Properties-Vehicle Interaction and presented at the Highway Research Board 50th Annual Meeting.

Friction tests using smooth and treaded tires with 10- and 24-psi tire-inflation pressures on wet and dry surfaces were taken with a Mu-meter and the Texas Highway Department research skid trailer. Fifteen pavement surfaces that exhibited widely different friction levels, friction-velocity gradients, drainage capabilities, mineralogical properties, and texture classifications were investigated. Pavement macrotexture tests were conducted by volumetric and mechanical

roughness detector methods. Comparisons and relationships between various friction parameters as obtained with both instruments were made. Statistical analyses and typical plots are given. Friction tests obtained with both instruments compared favorably, provided similar tire tread configurations were used. On an average, slightly higher friction forces were available in the slip mode of operation (measured by Mu-meter) than in the skid mode (measured by skid trailer). The importance of providing adequate drainage in the tire-pavement contact area is stressed.

Search terms: Friction tests; Pavement tests; Tire pavement interface; Pavement skid resistance; Coefficient of friction; Measuring instruments; Pavement surface texture; Cornering; Pavement friction; Tire inflation pressure; Tire tread depths; Wet road conditions; Dry road conditions; Surface drainage; Skid resistance tests; Statistical analysis; Slip; Velocity; Skidding

HS-012 042 Fld. 2/4

SPECIALIZED ROAD SURFACES FOR TRACTION TEST PURPOSES

by C. V. Allen; F. D. Smithson

General Motors Proving Ground

1972 11p 6refs
Report no. SAE-720469

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

There is a growing need for specialized road surfaces in order to conduct a variety of tire and/or vehicle tests. Surfaces which would fulfill this need should meet the following objectives: be entirely prescribable utilizing easily obtainable components and simple construction techniques provide the desired frictional characteristics; and exhibit reasonable durability. This paper discusses the basic characteristics of road surfaces

2/4 Design and Construction (Cont'd.)

HS-012 042 (Cont'd.)

which influence their frictional performance and must be controlled to obtain the desired results. These frictional phenomena are then related to specific tests to explain how they can influence results. This discussion provides the basis for an outline of the development of a specialized road surface which was designed to meet the previously outlined objectives.

Search terms: Road surfaces; Pavement surface texture; Coefficient of friction; Pavement skidding characteristics; Friction tests; Pavement friction; Antiskid materials; Antiskid coatings; Friction materials; Wheel locking friction; Proving grounds; Speed; Friction studies

AVAILABILITY: SAE

HS-012 045 Fld. 2/4; 4/3

INDEPENDENT VERSUS NARROW-MEDIAN ALIGNMENT: COMPARATIVE ECONOMY, SAFETY, AND AESTHETICS

by J. S. Peet; D. Neuzil

Published in *Highway Research Record* n390 p1-14 (1972)

9refs

Sponsored by Highway Research Board Committee on Geometric Highway Design.

Independent alignments and other wide-median designs are generally superior to narrow-median designs from the standpoint of safety and aesthetics. For a wide range of design and cost conditions often associated with rural and suburban

design team. Annual costs of selected independent alignment and narrow-median designs are presented for a range of cost and terrain factors. Safety performance requirements are incorporated in a comparison chart that permits rapid, preliminary economic evaluation of typical alternative median designs.

Search terms: Highway design; Highway characteristics; Medians; Aesthetics; Alignment; Highway economic factors; Divided highways; Highway costs; Median width; Median barriers; Embankments; Right of way (land); Economic analysis; Slopes; Safety design; Rural highways

HS-012 049 Fld. 2/4

TRAFFIC OPERATIONS PROGRAM TO INCREASE CAPACITY AND SAFETY

by J. D. Lacy

Published in *Traffic Quarterly* v26 n3 p327-40 (Jul 1972)

TOPICS, a federally funded program, assists urban areas of more than 5,000 population in the systematic application of traffic engineering techniques to obtain the maximum efficiency and safety from the existing street and highway system. The history and status of the program and the distribution of TOPICS funds are discussed. Completed and proposed TOPICS projects include: intersection improvements, elimination of a railroad at-grade crossing, street extension, highway lighting, replacement of angle parking, computerized traffic control systems, elimination of bottlenecks, freeway ramp metering, median barrier installation, and construction of bus facilities.

Search terms: Traffic Operations Program to Increase Capacity and Safety; Federal aid; Highway improvements;

Traffic engineering; Traffic impedances; Channelized intersections; Angle parking

2/5 Lighting

HS-012 001 Fld. 2/5

A STATIC SCALE-MODEL SIMULATOR FOR THE STUDY OF VISIBILITY AND HIGHWAY LIGHTING

by H. R. Blackwell; O. M. Blackwell

Published in *Highway Research Record* n377 p24-31 (1971)

1ref

Sponsored by Highway Research Board Committee on Visibility and Presented at the 50th annual meeting.

Field studies of visibility and highway lighting have proved difficult and expensive. Accordingly, a scale-model simulator to use as an adjunct to field measurements has been developed. The intention is that the simulator be used first in a careful series of studies, followed by spot-checking in the field. Tests conducted both in the simulator and in the field will involve static viewing at the outset. Subsequently, it may be possible to extend the measurement techniques for use under dynamic conditions.

Search terms: Highway lighting; Road simulators; Luminaires; Photometers; Visibility; Lighting measurement; Simulation models; Scale models; Luminance

2/9 Traffic Control

HS-012 009 Fld. 2/9

A BRIGHTNESS INVENTORY OF

25refs

Sponsored by Highway Research Board Committee on Visibility and presented at the 50th annual meeting.

The purpose of this study is to measure the brightness of contemporary sign materials in actual use situations, as observed by the driver under normal day-time and nighttime viewing conditions. Determinations were made for 7 approach distances for high and low beams at night and for 2 distances by day. Luminance readings were obtained for 4 legend materials, 3 background materials, and 18 conditions of sign surround. Results indicated that luminances for sign legends of over 1 foot-lambert are available on low beams for encapsulated lens and button reflective materials on unlighted overhead signs for the legibility distances available. Three legend materials are in excess of this level for the shoulder-mounted location on low beams. This luminance level has been suggested by earlier investigators as the minimum level for adequate legibility. With high beams, luminances of 10 to 20 foot-lamberts, equivalent to those exhibited for illuminated overheads, are available for several materials on both overhead and shoulder-mounted signs.

Search terms: Sign materials; Sign visibility; Sign reflectance; Sign legibility; Sign lighting; Night visibility; Overhead signs; Photometers; Brightness; Luminance; Sight distances; High beamed headlamps; Low beamed headlamps

HS-012 012 Fld. 2/9; 3/12

A MEASURE OF THE DELINEATION POTENTIAL OF COLORED PAVEMENT

by W. Taylor; T. Datta

Published in *Highway Research Record*
n377 p103-17 (1971)

1refs

Sponsored by Highway Research Board Committee on Visibility.

This paper presents the results of a study designed to establish a quantitative measure of color contrast and to determine the effect of six independent variables on this measure. This measure, called the chromaticity vector, was defined as a function of standard chromaticity charts, and a series of tests was run to establish its reliability as a measure of a subject's ability to differentiate two colors. The six independent variables used in the testing were pavement color, type of lighting, effect of rain, bead size and type, angle of incidence of the source light, and simulated wear and weather exposure. The results of the analyses indicate that the proper selection of color combinations and lighting can increase the potential for differentiating colors by a ratio of 3 to 1; the problems of night visibility can be partially counteracted by the application of beads; and the color contrast vector approaches zero when the pavement is covered with a water film.

Search terms: Colored pavements; Chromaticity; Night visibility; Pavement reflectivity; Light conditions; Wet road conditions; Dry road conditions; Glass beads; Rain; Color perception; Laboratory tests; Spectral analysis; Contrast; Pavement wear; Vision tests; Sight distances; Regression analysis

HS-012 025 Fld. 2/9; 3/4

DRIVER RESPONSE TO AN ICY BRIDGE WARNING SIGN

by D. R. Kobett; W. D. Glauz; G. G. Balmer

Published in *Traffic Engineering* v42 n10
p18-23 (Jul 1972)

4refs

Contract FH-11-7428

A field evaluation was made of driver response to a sign warning of an icy bridge. Types of data collected included speed measurements, traffic distribution to lane, counts of lane changes, brake light occurrences, and driver interviews. Comparative measurements were made with and without the sign. Speed reductions between a control point upstream from the bridge and at the bridge were used as the principal measure of driver response. On the first three days, the speeds showed a statistically significant reduction of about 7 mph while the sign was activated. There was some indication that the warning sign increased the amount of lane change activity in the vicinity of the bridge.

Search terms: Ice warning signs; Bridges; Speed patterns; Kansas City (Mo.); Braking; Lane changing; Driver interviews; Data acquisition; Flashing warning signals

HS-012 037 Fld. 2/9

SPEED CONTROL DESIGN BY PHYSICAL MEANS: BIBLIOGRAPHY

by F. S. White

Texas A and M Univ. Texas Transp. Inst.

1971 11p 12refs
Report no. PB-205 754

Sponsored by Texas Hwy. Dept. in cooperation with the Federal Hwy. Administration.

A selective bibliography with abstracts is presented. Coverage is limited to technical journals and reports. Subjects covered include colored pavements, pavement markings, aggregates, and rumble strips.

Search terms: Bibliographies; Abstracts; Speed control; Traffic control devices; Rumble strips; Colored pavements; Pavement markings; Aggregates

AVAILABILITY: NTIS

HS-012 050 Fld. 2/10; 3/6

THE ADMINISTRATIVE ADJUDICATION OF TRAFFIC VIOLATIONS IN NEW YORK CITY

by V. L. Tofany

Published in *Traffic Quarterly* v26 n3
p319-26 (Jul 1972)

5refs

In 1970 the Administrative Adjudication Bureau of the New York State Department of Motor Vehicles was created to hear traffic cases. Prior to this time all traffic infractions in the city were processed by the Criminal Court. The Administrative Adjudication Bureau is a new approach to the disposition of traffic violations that should alleviate the crowding of urban courts. It also operates as a marked improvement in promoting highway safety through the control of drivers. Because of the computerization of files and schedules, hearings are usually held within three weeks of a violation. The traffic offender is therefore promptly brought to justice and, if his offense warrants it, quickly removed from the road. Moreover, the bureau is an entirely self-supporting agency that is in most respects more economical than the judicial system.

Search terms: Traffic law enforcement; Traffic law violations; Traffic law violators; Hearings; Fines; Driver license revocation; Driver license suspension; Computerized driver records; New York (City); Traffic courts; Driver prosecution; Problem drivers

3/0 HUMAN FACTORS

HS-012 008 Fld. 3/0

THE DENVER SYMPOSIUM ON MASS COMMUNICATIONS RESEARCH FOR SAFETY. A CRITICAL REVIEW OF THE LITERA-**TURE AND A PROPOSED THEORY BY H. A. MENDELSON**

by M. Blumenthal, ed.

1964 297p 393refs

The review and original theory of accident causation were evaluated by professionals from the media, universities, safety and safety-related organizations at a two day symposium. The objectives of the study were: development of a comprehensive bibliography of materials pertaining to effective communication of traffic safety messages; description of the current state of the art; development of effective communication principles for traffic safety; and the development of guidelines for programming in traffic safety. Selected sections are included of the critique concerning the goals of mass communications for safety, methods and techniques in the use of the mass media, the content of traffic safety communications, and the effectiveness of the mass media.

Search terms: Information theory; Mass media; Safety education; Communication systems; Safety research; Reviews; Accident causes; Safety campaigns; Program evaluation; Psychological factors; Probability theory; Public information programs; Driver behavior research; Attitudes; Flow charts; Motivation research; Behavior; Safety propaganda; Community support; State of the art studies

3/1 Alcohol

HS-012 016 Fld. 3/1

A PANORAMIC VIEW OF ALCOHOL, DRUGS, AND TRAFFIC SAFETY

by R. F. Borckenstein

Published in *Police* v16 n11 p6-15 (Jul 1972)

The problem of the drinking driver is discussed in terms of the historical develop-

ment of traffic law enforcement, classification of types of drinkers, and the role of the public in better alcohol law enforcement. Lack of public understanding and support hampers attempts to control drinking drivers. Ten recommendations are made for dealing with the problem, including coordination of federal efforts to control the drinking driver; implementation of the highway safety standard on alcohol; research on driving impairment by alcohol; more flexibility in the criminal justice system for dealing with drinking drivers; more varied sentences of convicted drinking drivers; mandatory treatment of alcoholism; more alcohol education; more research on drug abuse; development of a self-test for drinkers to determine whether they can safely drive; and development of adequate statistical facilities dealing with the alcohol problem.

Search terms: Drinking drivers; Alcohol education; Alcohol blood tests; Alcohol laws; Driver intoxication; Driver rehabilitation; Driver personality; Penalties; Driver license suspension; Drug addiction; Blood alcohol levels; Traffic law enforcement; Federal aid; Community support; Problem drivers; Alcoholism; High risk drivers; Alcohol usage deterrents; Highway safety standards; Driver prosecution

HS-012 027 Fld. 3/1

THE DENVER AREA DRINKING-DRIVING SURVEY (1971). REPORT

by A. C. Wolfe

Published in *HIT Lab Reports* p1-12 (May 1972)

14refs

For full report see HS-011 645.

A sample of 504 persons of driving age were interviewed in a survey of households in the Denver area. The interviews covered general knowledge and attitudes about highway safety; knowledge of the

impairment; willingness to support alcohol countermeasure programs, and attitudes toward various countermeasures; awareness of media messages on drinking and driving; awareness of the Denver alcohol countermeasures program; attitudes toward alcoholism and awareness of sources of alcohol help; self-reported drinking patterns, driving experience, and driving after drinking; and demographic and background information on the respondent. The results provide baseline information for developing and evaluating the public information element of the 3-year Denver Alcohol Safety Action Program. The diversity within drinking/driving-type subgroups indicates that public information efforts and countermeasures cannot be directed at a single particular type of driver in the Denver area.

Search terms: Alcohol Safety Action Projects; Denver; Drinking drivers; Alcohol education; Public information programs; Driver characteristics; Ethnic groups; Driver attitudes; Driver age; Driver sex; Driver educational levels; Driver occupation; Surveys; Interviews; Alcohol usage

HS-012 054 Fld. 3/1; 3/6

AN ASSESSMENT OF THE LIMITED DRIVING LICENSE AMENDMENT TO THE NORTH CAROLINA STATUTES RELATING TO DRUNK DRIVING

by T. R. Johns; E. A. Pascarella

North Carolina Univ. Hwy. Safety Res. Center

1971 27p 2refs

Sponsored in part by the North Carolina Governor's Highway Safety Program.

This study evaluates a recent change in the North Carolina law relating to persons convicted of a first offense of driving under the influence of intoxicating liquor (DUI). This change provides the court with the option of granting some

privilege, whenever a need to drive is indicated, in lieu of the mandatory revocation of their licenses. This alternative penalty was expected to result in: a change in the proportion of DUI convictions and in DUI charges amended to reckless driving; and a reduction in the limited privilege recipients' accident and violation rates. The driving record of the limited driving recipients, for the year following their conviction, was compared with that of a random sample of drivers. It was found that the recipients' violation rate per 100 drivers (4.6) was significantly lower than that of drivers selected at random (12.9). Their accident rate (7.8) was not significantly different from that of the random sample (7.5).

Search terms: North Carolina; Driver license restrictions; Drinking drivers; Accident rates; Traffic law violators; Driver records; Driver license revocation; Convictions; Chi square test; Age factor in accidents; Reckless driving; Traffic law violations

HS-810 236 Fld. 3/1

SPEECH TO THE REGIONAL ADMINISTRATORS

by R. B. Voas

National Hwy. Traf. Safety Administration

1972 17p

NHTSA's Alcohol Countermeasures Program is described. The four major elements of the program are: research and development designed to put new tools into the hands of local agencies; a public information program designed to gain public support for local action; the state and community matching grant program which assists states in their efforts to design comprehensive safety programs in the alcohol area; and Alcohol Safety Action Projects at the local level to demonstrate the effectiveness of new countermeasures and to catalyze statewide action. The ASAP program is dis-

seminar; communities may receive contracts to participate in the program, preliminary results of enforcement programs, and costs.

Search terms: Alcohol Safety Action Projects; Drinking drivers; Alcoholism; Public information programs; Grants; Federal aid; Alcohol education; Traffic law enforcement; Driver rehabilitation; Social drinking; Blood alcohol levels; Alcohol usage deterrents; Driver intoxication; Accident responsibility; Problem drivers; State action

AVAILABILITY: NHTSA

HS-810 237 Fld. 3/1

REMARKS DELIVERED TO OPENING OF THE SOUTH DAKOTA ASAP, NOVEMBER 30, 1971

by R. B. Voas

National Hwy. Traf. Safety Administration

1971 7p

The key element in locating the problem drinker is intensified enforcement on the highway. This increased enforcement effort should also result in deterrence of the heavy social drinker who still has his drinking under control. The Alcohol Safety Action Program surrounds the problem drinker who drives with a system which ensures his apprehension and prosecution, but then follows this with a system which ensures that he will be motivated to seek treatment as a condition of probation rather than receive the current standard but ineffective penalties.

Search terms: Alcohol Safety Action Projects; Drinking drivers; Driver rehabilitation; Problem drivers; Social drinking; Community support; Alcoholism; Traffic law enforcement; Driver intoxication; Blood alcohol levels; Alcohol usage deterrents

AVAILABILITY: NHTSA

HS-012 029 Fld. 3/2; 4/7; 1/2

BIODYNAMIC MODELS AND THEIR APPLICATIONS

by H. E. von Gierke

Aerospace Medical Res. Lab. (6570th)

Published in *AGARD Conference Proceedings n88* (AGARD-CP-88-71) 1971 p13-(1-18)

60refs

Report no. AMRL-TR-71-51

Presented at the Aerospace Medical Panel Specialist Meeting, AGARD Conference on Linear Acceleration of Impact Type, Oporto, Portugal, 23-26 Jun 1971.

Progress in modeling the mechanical response of man exposed to various environmental forces is discussed. Starting with a mathematical description of the mechanical and physical characteristics of the integument, soft and hard tissue, the numerous approaches taken and the results obtained from modeling various integrated elements such as the human vertebral column under vibration and impact loads, the chest and respiratory system under vibratory and blast loads and of the whole body system for selected force input conditions and locations are reviewed. Generalized (5-degree and more) freedom models are best suited to understand the correlation between the models derived to explain anatomical and physiological mechanical events and models used to explain the various injury mechanisms under environmental biodynamic loads (impact, blast, vibration, and noise). To derive a capability of modeling specific injury modes or experimentally observed probabilities of injury curves for various parenchymatous and hollow organs as a function of the force input variables, more detailed and specialized models are being used such as, for example, the lumped parameter, discrete parameter and continuum model of the spine, or

behavior. The status and value of these models for studying the body's physical and physiological response, for understanding and predicting injury mechanisms and probability of injury, for scaling the results of animal experiments, and for applying the models in protection engineering, such as escape and restraint systems design, is demonstrated.

Search terms: Human body simulation; Mathematical models; Occupant modeling; Human body kinematics; Human body kinetics; Acceleration response; Injury research; Animal impact tolerances; Human body impact tolerances; Injury probability; Biodynamics; Degrees of freedom; Biokinematic models; Spinal impact tolerances; Parameters

HS-012 041 Fld. 3/2; 5/2; 5/20

DRIVER'S EYE POSITION RELATIVE TO THE 'H' POINT FOR TRUCKS AND BUSES

by H. P. Ruffell Smith

Transport and Road Res. Lab. (England)

1972 16p Srefs

Report no. TRRL-LR-440

The eye position of subjects has been measured while they were driving the prototype of a bus intended for public service and in a static mock up of this prototype. The average eye position observed in these tests was confirmed by photographing professional drivers while they drove an existing public service bus. With seat backs inclined at 10° , the average eye position was found to be between 10 and 11 cms. (4 and 4.5 ins.) in advance of the hip hinge point. The eye position found in this way agrees with an SAE recommendation but differs in its fore and aft dimension relative to the hip joint from that specified in some national and international regulations.

Search terms: Eye location; H point; Bus design; Truck design; Design

3/4 Driver Behavior

HS-012 028 Fld. 3/4; 1/3

THE ROLE OF THE BEHAVIORAL SCIENCES IN ACCIDENT REDUCTION—PROBLEMS AND ASPECTS

by F. L. McGuire

California Univ.

1966 25p 38refs

Presented at the Conference on the Automobile Accident: Behavioral Issues and Approaches, sponsored by The American Psychological Assoc., Big Sur Hot Springs, Calif, 31 May 1966.

Accident research requires study of the more basic aspects of human behavior and often has implications far beyond the highway. The field of highway safety is rich with problems that can be solved by the utilization of skills and abilities possessed by psychologists. Areas of research that could be investigated by psychologists include law enforcement, driver education, psychotherapy, and safety campaigns, and the effects they have on human behavior and accident prevention. Human engineering and driver personality are other areas that need study. A summary of studies already completed evaluating ways of influencing accident producing behavior are included.

Search terms: Accident research; Driver behavior research; Driver education evaluation; Driver improvement measurement; Accident rates; Law enforcement effect on accident rates; Safety campaigns; Driver personality; Accident proneness; Psychotherapy; Driver counseling; Problem drivers

TOWARD AN ATTITUDE INSTRUMENT TO PREDICT DRIVING BEHAVIOR. A RESEARCH REPORT

by R. E. Clasen; L. R. Nelson

Wisconsin Univ.; Colorado Univ.

1972 15p 10refs

One-hundred and twenty-one college students doing safety education course work responded to a 50-item attitude inventory and reported their violation and accident records since obtaining their licenses. Results were factor analyzed, regression analyses were performed, and an analysis of variance was performed on the data. The instrument predicted violations but not accidents. The instrument is presented, effective items are identified, and recommendations for further research are made.

Search terms: Driver attitudes; Factor analysis; Regression analysis; Variance analysis; Traffic law violations; Questionnaires; Driver behavior; Driver attitude measurement; Accident rates; Traffic law violation forecasting; College students; Accident risk forecasting; Male drivers; Female drivers

3/5 Driver Education

HS-012 043 Fld. 3/5; 3/6

RESEARCH CHALLENGES IN DRIVER EDUCATION AND DRIVER LICENSING

by C. H. Hartman

Published in *Highway Research Record* n365 p9-16 (1971)

Sponsored by Committee on Road User Characteristics and presented at the Highway Research Board 50th Annual Meeting.

Driver education and driver licensing represent potential payoff areas of con-

spire research and program challenges are identified and met. The eleven challenges identified and discussed are: to make certain that research efforts provide useful answers; to build the required base to determine the payoffs of driver education and driver licensing; to convince legislators that adequate financing is needed; to determine the effect of driver education on subsequent driver performance; to establish controlled field research projects in education and licensing; to achieve a consensus on the makeup of the driving task; to develop objective criteria for traffic safety and flow; to develop measuring techniques and tools to assess driving proficiency; to identify the most appropriate roles for various devices and facilities in the education and licensing process; to define the relevant data set that must be gathered in the licensing process; and to make license enforcement activities more effective.

Search terms: Driver education; Driver licensing; Program evaluation; Research methods; Financing; Driver performance; Traffic flow; Driver skills; Driving task analysis; Driver education evaluation; Driver behavior research

4/0 OTHER SAFETY-RELATED AREAS

4/1 Codes and Laws

HS-012 014 Fld. 4/1

HAZARDOUS MATERIALS CONTROL, HAZARDOUS MATERIALS CONTROL ACT OF 1970. SECOND ANNUAL REPORT OF THE SECRETARY OF TRANSPORTATION, CALENDAR YEAR 1971

Department of Transp.

1972 155p

This report includes: a statistical compilation of the accidents and casualties occurring in 1971 which involved the transportation of hazardous materials; a

summary of the reason for each waiver or exemption granted; an evaluation of the degree of observance of safety standards for the transportation of hazardous materials; and a summary of outstanding problems created by the transportation of hazardous materials.

Search terms: Transportation of hazardous materials; Transportation of explosives; Transportation of radioactive materials; Rail transportation; Highway transportation; Motor carriers; Air transportation; Marine transportation; Accident statistics; Fatalities; Injury statistics; Property damage accidents; Regulation waivers; Regulation enforcement; Safety standards compliance; Annual reports; Hazardous materials; Accident reports

4/2 Community Support

HS-810 234 Fld. 4/2

JET LAG AND HIGHWAY SAFETY

by C. H. Hartman

National Hwy. Traf. Safety Administration

1972 9p

Presented at National Association of Women Highway Safety Leaders Annual Highway Safety Conference, Washington, D. C., 2 Oct 1972.

It is suggested that the highway safety movement suffers from jet lag—needs and wants are attuned to one time zone while plans, programs, and action are in another. Reasons for this lag are individual apathy, higher priority of other programs, and resistance to safety program standards. A plea is made for greater citizen-official cooperation and involvement in highway safety programs.

Search terms: Highway safety programs; Highway safety organizations; Community support

5/0 VEHICLE SAFETY

Curtiss-Wright Corp.

5/4 Design

1972 23p 26refs
Report no. SAE-720468

HS-011 990 Fld. 5/4

IMPROVEMENTS OF THE ROTARY ENGINE WITH A CHARGE COOLED ROTOR

by K. Yamaoka; H. Tado

Yanmar Diesel Engine Co. Ltd. (Japan)

1972 20p
Report no. SAE-720466

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

This paper covers the features of rotary engines with charge-cooled rotors developed by Yanmar Diesel Engine Co., Ltd. It includes test results obtained with charge-cooled rotors during the course of development of the engine with this feature. With continuing new applications of the NSU/Wankel rotary engine, charge-cooling appears to be a promising feature, especially in small-sized engines, from the point of view of simple structure and improved economy.

Search terms: Wankel engines; Rotary engines; Intake systems; Air cooled engines; Engine tests; Cooling systems; Water cooled engines; Ports (openings); Combustion chamber design; Lubricating oils; Lubrication; Engine performance; Engine speeds; Charge cooled rotors; Spark plugs; Compression ratio

AVAILABILITY: SAE

HS-011 998 Fld. 5/4

A SURVEY OF CURTISS-WRIGHT'S 1958-1971 ROTATING COMBUSTION ENGINE TECHNOLOGICAL DEVELOPMENTS

by C. Jones

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

This paper summarizes the highlights of developments of the rotating combustion (RC) engine at Curtiss-Wright Corp. in each of several principal areas; speculates on remaining directions, both within and without the framework of previous explorations; and briefly describes germane technical features of the engines used in commercial applications of other licensees. Design features, testing, and ramifications of the RC1-60 rig engine are examined in detail. The application of the fundamentals and principles of the RC engine to automotive, aircraft, and small, air-cooled engines is also described.

Search terms: Rotary engines; Wankel engines; Cooling systems; Apex seals; Oil seals; Air cooled engines; Stratified charge engines; Fuel economy; Aircraft engines; Engine design; Engine performance; Spark plugs; Engine speeds; Fuel consumption

AVAILABILITY: SAE

HS-012 000 Fld. 5/4

LUBRICANT STUDIES IN ROTARY-COMBUSTION ENGINES

by T. W. Rogers; W. Lemke; J. Lefevre; T. Ohzawa

Mobil Res. and Devel. Corp.; Mobil Oil A.G. (West Germany); Mobil Oil France; Mobil Sekiyu K. K. (Japan)

1972 14p 15refs
Report no. SAE-720467

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Discussion of the rotary-combustion engine's history, operation, and lubrication illustrates the role of various quality level engine oils in providing the necessary functions of engine seal wear protection, bearing lubrication, rotor cooling, and overall combustion chamber area cleanliness. Specific examples of current quality and experimental-type engine oil influence on overall engine durability, including seal and housing surface wear, are cited for various engine designs. Data evaluating lube oil effects on engine cleanliness and oil consumption characteristics are also discussed. Analysis of used oil from a number of test engines is presented showing the rotary-combustion engine to yield oil deterioration typical of current piston engines.

Search terms: Rotary piston engines; Wankel engines; Lubrication systems; Apex seals; Oil seals; Lubricating oils; Water cooled engines; Lubricating oil tests; Engine wear; Air cooled engines; Road tests; Engine tests; Wear tests; Engine operating conditions; Laboratory tests

AVAILABILITY: SAE

HS-012 011 Fld. 5/4

STUDIES OF TEST METHODS FOR EVALUATING TWO-CYCLE ENGINE OILS

by R. Ohgake; T. Hidaka

Nippon Oil Co. Ltd. (Japan)

1972 22p 5refs
Report no. SAE-720452

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

In Japan, test methods for evaluating the performance of 2-cycle engine oils have been developed separately by each 2-cycle engine manufacturer. The reason for this is that there are many differences in engine performance and in lubri-

uating the performance of engine oils. Yamaha Motor developed a "70 min engine test method" in 1963, which can be conducted in a relatively short period of time with good reproducibility. Several problems regarding Yamaha's 70 min engine test method are discussed.

Search terms: Two stroke cycle engines; Engine tests; Lubricating oil tests; Oil pumps; Viscosity; Detergency; Engine performance; Lubrication systems; Engine operating conditions; Field tests; Performance tests

AVAILABILITY: SAE

HS-012 024 Fld. 5/4; 2/4

WELDING FOR STRENGTH

by H. N. Irvine

Hawkeye Inst. of Tech.

7p 9refs

Report no. SAE-720358

Presented at SAE Mississippi Valley Section, 4 Nov 1971.

Modern design trends are placing greater demands on welded structures. This paper discusses the present state of the art and provides recommendations for dealing with some of the more commonly encountered structural problems. Emphasis is placed on stress concentration and fatigue strength and the relation of these factors to welding practices and methods. Formulas needed to compute stress and strength are presented. Characteristics of various types of materials, of fillet size, and of good bonding welds are described and compared.

Search terms: Welding; Welds; Stress (mechanics); Fatigue (materials); Strength (mechanics); Fillets

AVAILABILITY: SAE

by S. Romack

Deere and Co.

1971 17p 40refs

Report no. SAE-720361

Presented at SAE Mississippi Valley Section, 4 Nov 1971.

The importance of the stress concentration factor in design of structures is emphasized. Design for static stress concentration and design for fatigue stress concentration with ductile and brittle materials has been described. Changes in the critical areas to minimize stress concentration and examples with typical cases of critical areas of discontinuities are given. A table with design techniques for improving fatigue strength and a few stress concentration charts have been enclosed which are typical in the construction.

Search terms: Stress (mechanics); Fatigue (materials); Stress analysis; Structural design; Load bearing capacity; Torsion; Notch sensitivity; Fatigue life; Failure stress; Bending; Steels; Fillets; Shear stress; Mathematical analysis; Mathematical models; Strength (mechanics)

AVAILABILITY: SAE

HS-012 032 Fld. 5/4; 5/14

AUTOMOBILE STRUCTURAL CRASHWORTHINESS CONCEPTS FOR CRASH PROTECTION

by P. M. Miller

Cornell Aeronautical Lab., Inc.

Published in *AGARD Conference Proceedings n88* (AGARD-CP-88-71) 1971 22-(1-16)

19refs

CONFERENCE ON
Impact Type, Oporto, Portugal, 23-26 Jun 1971.

A series of full scale automobile crash tests were conducted to determine the structural crashworthiness performance of conventional automobiles and to evaluate the performance of structural concepts designed to provide protection during frontal and lateral impacts with fixed objects. The frontal structural modifications considered both front and rear engine vehicle designs and were evaluated under impacts with a rigid pole barrier where the collision speeds ranged from 35 mph to 63 mph. These structural modifications were designed so that the entire distance in front of the passenger compartment could be used for energy absorption. Although not a major part of the study, the effect of the modified structure on occupant protection when coupled with an air bag restraint system was also investigated throughout this velocity range. The results demonstrated that the modifications when coupled with this restraint system provide for a force limiting system on the occupant for this range of impact conditions.

Search terms: Automobile modification; Crashworthy bodies; Side impact tests; Head on impact tests; Barrier collision tests; Pole impact tests; Crashworthiness; Displacement; Deceleration; Energy absorbing front structures; Air bag restraint systems; Restraint system tests; Front engine vehicles; Rear engine vehicles; Crush distance; Sliding ramps; Energy absorbing frames; Door design; Roll bars; Occupant protection

HS-012 047 Fld. 5/4; 4/4

SOME INTERNATIONAL ASPECTS OF ROAD SAFETY INVOLVING THE NATO COMMUNITY

by R. Brenner

National Highway Traffic Safety Administration

Published in *Highway Research Record*
n365 p1-8 (1971)

2refs

Sponsored by Committee on Road User Characteristics and presented at the Highway Research Board 50th Annual Meeting.

In 1969 NATO created the Committee on the Challenges of Modern Society (CCMS) to deal with social problems of industrial society. CCMS has adopted an approach in which a single country assumes primary responsibility for a given area of research. The U. S. is involved in a pilot study on road safety. A major thrust of this study is the development of an experimental safety vehicle. This project and its implications for highway safety are briefly discussed.

Search terms: Experimental vehicles; Safety cars; Highway safety programs; International compacts; Automobile design; North Atlantic Treaty Organization

HS-012 051 Fld. 5/4

POLYOLEFIN STRUCTURAL FOAM FOR AUTOMOTIVE USE

by D. P. Hug; C. C. Shockley

Hercules, Inc.

1972 9p 8refs
Report no. SAE-720475

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Polyolefin structural foams have the potential for large usage in the automo-

bile industry. Lighter vehicle weight, lower cost, better balance to offset safety and antipollution devices, greater collision safety, noise reduction, better resistance to corrosion, and a smoother ride. Preliminary designs and economic studies were performed for several automobile parts including bucket seats, hoods, rear deck lids, dash panel inserts, air-conditioner housings, and fan shrouds.

Search terms: Polyolefin structural foams; Polypropylene; Molding; Automobile materials; Bucket seats; Hoods; Automotive parts; Chemical properties; Instrument panels; Fans

AVAILABILITY: SAE

HS-012 052 Fld. 5/4; 5/14

MORE THOROUGHLY SAFE?

by M. Scarlett

Published in *Autocar* v136 n3976 p20-2
(29 Jun 1972)

The hybrid cushion car, advocated by David Foster in his book, *The Absolute Safe Car*, is described. By means of the car's nose-crushability, seat belt retardation at a maximum rate of around 12g, and a padding system which will decelerate a person safely at up to 40g when he hits the inside of the car, the passengers can be preserved from injury. Air bags, padding systems, and seat belts are discussed. The instrument panel would be completely redesigned and heavily padded.

Search terms: Safety cars; Injury prevention; Padding; Air bag restraint systems; Seat belts; Secondary collisions; Occupant protection; Hybrid automobiles; Human deceleration tolerances; Experimental automobiles; Instrument panel design

by E. J. Thompson; H. E. Reymore; R. L. Griewe; A. A. R. Sayigh

Upjohn Co.

1972 9p 8refs
Report no. SAE-720476

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Over the past few years there has been a growing interest in the applications of isocyanate-based structural foams (Dermathane). Molds and tooling are critical to making a good article. Experience is the principal teacher in this area of technology. An analysis of various toolings and applications tells what is necessary and what is unnecessary. Density is well-known as the most important variable when strength is considered. However, when sandwich-like structures are involved, the analysis for strength becomes more complicated. This paper includes all the processing and design information necessary for using Dermathane at the optimum strength and economy. A number of automotive applications are mentioned.

Search terms: Structural foams; Plastic foams; Molding; Flexion; Density; Thickness; Strength (mechanics); Isocyanates; Physical properties; Automotive materials

AVAILABILITY: SAE

HS-012 055 Fld. 5/4

DESIGN ASPECTS OF EXPANDED ABS

by J. A. Helgesen

Borg-Warner Corp.

1972 5p
Report no. SAE-720477

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Expanded ABS, a terpolymer of acrylonitrile-butadiene-styrene, is discussed. The physical properties of this material are described, particularly with respect to furniture production. The expansion casting process is described, casting recommendations presented, and equipment detailed. Design and finishing are explored in some detail, and comparisons with wood and other furniture materials are offered.

Search terms: Polyacrylonitrile; Butadienes; Styrene; Casting; Molding; Physical properties; Polymers

AVAILABILITY: SAE

S-012 057 Fld. 5/4

FIBERGLASS REINFORCED THERMOPLASTIC STRUCTURAL FOAM

R. K. Mount
Dart Industries, Inc.

1972 7p 3refs
Report no. SAE-720478

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

New glass-reinforced thermoplastic foam resins have been developed that can be molded on conventional screw injection molding machines. The glass reinforcement of the thermoplastic foams results in the restoration of physical properties normally lost when unreinforced thermoplastics are foamed. Advantages that can be gained from the utilization of fiberglass-reinforced thermoplastic foams include: increased strength of cellular structure; sink free parts; stress free parts; molding on conventional screw-injection molding machines; high strength-to-weight ratio and excellent

retention; low tooling costs; and faster cycles.

Search terms: Structural foams; Thermoplastics; Glass fiber reinforced plastics; Fiberglass; Molding; Physical properties; Automotive parts; Automobile materials

AVAILABILITY: SAE

HS-012 059 Fld. 5/4

METAL FOAMS AS ENERGY ABSORBERS FOR AUTOMOBILE BUMPERS

by L. M. Niebyski; R. J. Fanning

Ethyl Corp.

1972 8p 8refs
Report no. SAE-720490

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Evaluations of aluminum foams show they can be efficient energy absorbers. They are especially interesting because they have virtually no rebounding characteristics. The load-compression response characteristics of the foam can be controlled by variations of alloy composition and foam density, thereby controlling foam strength and ductility. This makes foamed metals attractive candidates for a number of automotive energy-absorption applications. The energy-absorption properties of a number of aluminum alloy foams have been studied under low and medium speed impact, up to 25 mph. The foam density, volume, and size required for a 5 mph single shot impact shock absorber have been determined for two automotive weight classes. Nonshearing columnar, high-density foam structures have been developed to withstand basal compressive loads. These columns have potential for multi-impact shock-absorbing applications. Work is currently under way to define foamed aluminum prop-

bumpers for 50 mph barrier and pole impacts.

Search terms: Metal foams; Aluminum alloys; Mechanical properties; Physical properties; Static tests; Compression; Impact tests; Energy absorbing bumpers; Bumper design; Low speed impact tests

AVAILABILITY: SAE

HS-012 061 Fld. 5/4

DEVELOPMENT OF THE FIRST SHEET MOLDING COMPOUND (SMC) BODY COMPONENT: THE CHRYSLER STATION WAGON AIR DEFLECTOR

by G. J. Currier

Chrysler Corp.

1972 5p
Report no. SAE-720493

Presented at the National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

The Chrysler Corporation made use of a thermosetting polyester sheet-molding compound (SMC) to provide an efficient, neat-appearing, and economical station wagon air deflector for its 1969 full-size station wagons. This marked Chrysler's first usage of this material for a major automotive body component. Without the deflector the difficulty arises at increased speeds when air passing along the roof of the vehicle is forced to achieve a somewhat greater velocity than that traveling along the vertical surfaces. A partial vacuum is thus created at the tailgate area drawing dust and road film across its surface or through the open rear window.

Search terms: Station wagons; Dust deflection; Air flow; Body aerodynamics; Thermosetting resins; Rear windows; Spoilers; Polyester

HS-012 062 Fld. 5/4

THE 1973 CHRYSLER ENERGY ABSORBING BUMPER SYSTEM

by J. D. Withrow; D. N. Renneker

Chrysler Corp.

1972 11p

Report no. SAE-720491

Presented at the National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Chrysler Corporation has designed its 1973 bumpers to meet and exceed the 1973 DOT exterior protection standards by methodically analyzing the impact event and developing an efficient energy management scheme which takes full advantage of the vehicle as an energy absorber. Additional energy absorption is provided by the efficient use of elastomeric bumper guards. This system has proven to be both theoretically and practically efficient for impact speeds up to 5 mph. There are several materials that can be considered for use as impact pads. These materials have various properties over the full temperature range but show efficiencies ranging from 25% to 40% at the effective stress levels. Although bumper systems will be improved industry-wide, a dramatic drop in property damage should not be expected for several years. It will take some time for vehicles with improved systems to gain a large enough percentage of total vehicle population to make the effects felt in the statistics.

Search terms: Energy absorbing bumpers; Bumper standards; Pendulum tests; Bumper design; Bumper guards; Elastomers; Safety standards compliance; Low speed impact tests

AVAILABILITY: SAE

HS-810 238 Fld. 5/4; 5/6

THE CAR OF THE FUTURE

National Hwy. Traf. Safety Administration

1972 20p

Presented at London Motor Show Symposium, 24 Oct 1972.

The safety, economic, and environmental factors which will affect the design, performance, and use of the automobile of 1980 are discussed. Legislation concerning safety, pollution, and reparability is reviewed with emphasis on existing safety standards in the areas of crash avoidance and crash survivability. Future standards and safety features are discussed as well as the increased costs resulting from compliance with the standards. Emission standards are discussed together with the costs of implementing the standards. The turnpike car and the commuter car are envisioned as the cars of the future. The turnpike car will be a 4,000 pound crashworthy vehicle used for long distances and will most likely be rented. The commuter car will be a 1,500 pound vehicle for shopping and commuting which will have limited speed, short cruising range, and very low exhaust emissions.

Search terms: Vehicle safety standards; Automobile maintenance; Vehicle inspection; Safety standards costs; Automobile performance; Occupant protection; Automobile safety characteristics; Exhaust emission standards; Vehicle size; Vehicle weight; Forecasting; Crashworthiness; Accident prevention; Accident survivability; Air pollution control costs; Repair costs

AVAILABILITY: NHTSA

5/6 Fuel Systems

HS-011 992 Fld. 5/6; 5/3

SMALL ENGINE EMISSIONS AND THEIR IMPACT

by C. T. Hare; K. J. Springer

Published in *SAE Journal of Automotive Engineering*, v80, n7, p15,25, 55, (1972)

24refs

Contract EHS-70-108

The Southwest Research Institute has developed emission characteristics for groups of small utility engines and motorcycle engines using available data where possible and generating emissions data in the laboratory where none was available. The small engines considered include household, lawn and garden, industrial, agricultural, and recreational applications of small 2-stroke and 4-stroke gasoline-fueled utility engines. Motorcycle engine emissions are discussed at length. Small engines appear to be responsible for about 0.3% of the hydrocarbons, 1% of the CO, 0.07% of the NOx, 0.04% of the particulates, and 0.004% of the SOx nationwide.

Search terms: Exhaust emissions measurement; Motorcycle engines; Two stroke cycle engines; Mowers; Hydrocarbons; Formaldehyde; Aliphatic aldehydes; Paraffins; Sulfur dioxide; Air cooled engines; Engine tests; Evaporative emission measurement; Engine size; Air pollution emission factors; Particulate air pollutants; Garden tractors; Four stroke cycle engines

HS-012 007 Fld. 5/6; 5/4; 4/7

TRANSIENT ENGINE TESTING BY COMPUTER CONTROL

by J. F. Cassidy, Jr.; J. H. Rillings

General Motors Res. Labs.

1972 42p 17refs

Report no. SAE-720454

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

This paper describes a computer controlled engine test cell designed for use as an engineering research tool for development and controlled dynamic testing of engine and engine subsystems. An IBM 1800 process control computer operating in a real time multitask envi-

controls an engine-dynamometer combination. The engine speed is controlled by an analog output voltage applied to the dynamometer speed control circuitry, and the engine torque is controlled by a digital output applied to a stepping motor driving the engine throttle. Test variables such as speed, torque, manifold vacuum, and exhaust emissions are automatically logged by the computer. The object is to combine the advantages of the controlled experimental conditions possible in an engine test cell with the dynamic capabilities of a vehicle driven on the road or on a chassis dynamometer. Typical engine torque, speed, and exhaust emission results are shown for a 1960 California cycle run on an engine test cell.

Search terms: Engine tests; Computerized test methods; Exhaust emissions measurement; Exhaust emission tests; Chassis dynamometers; Engine dynamometers; Computerized simulation; Dynamic tests; Engine speeds; Torque; Engine operating conditions; Throttling

AVAILABILITY: SAE

S-012 010 Fld. 5/6; 4/7

DEVELOPMENTS IN DYNAMOMETER CONTROL METHODS

by R. W. Clements; M. A. Richard

Chrysler Corp.

1972 6p
Report no. SAE-720453

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

The application of automation to dynamometer testing of engines has led to the development of specialized circuits and techniques to compensate for limitations inherent within the electromechanical systems used to implement automation theory. Stable, quick response to a programmed speed change has been

achieved for engine-automatic transmission testing by the use of a parallel feedback technique. Vehicle simulation using analog computer circuitry and road test data is used to calculate torque requirements from programmed acceleration-time and velocity-time curves. Similar circuitry is used to calculate engine-transmission output torque from dynamometer parameters. The techniques can be used for exhaust emission testing of car and truck engines.

Search terms: Engine tests; Engine dynamometers; Computerized test methods; Exhaust emission tests; Computerized simulation; Exhaust emissions measurement; Analog computers

AVAILABILITY: SAE

HS-012 038 Fld. 5/6

A COMPARISON OF DYNAMIC EXHAUST EMISSIONS TESTS: CHASSIS DYNAMOMETER VS. ENGINE DYNAMOMETER

by J. F. Cassidy, Jr.

General Motors Res. Labs.

1972 27p 3refs
Report no. SAE-720455

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Exhaust emission tests run on an engine dynamometer are compared with those run on a chassis dynamometer. The worst case average difference between the chassis and engine dynamometer mass emissions, obtained over a period of six months, was less than 7%. The elimination of the driver, vehicle, and chassis dynamometer yielded significant improvement in test reproducibility with respect to carbon monoxide and oxides of nitrogen. A digital computer was used to control speed and throttle position of the engine dynamometer experiments. No transmission was used. The computer

and engine dynamometer duplicated transient effects of transmission, vehicle, and chassis dynamometer.

Search terms: Chassis dynamometers; Engine dynamometers; Exhaust emission tests; Computerized test methods; Digital computers; Exhaust emissions measurement; Hydrocarbons; Carbon monoxide; Nitrogen oxides; Statistical analysis; Engine speeds

AVAILABILITY: SAE

HS-012 040 Fld. 5/6

PUBLIC CONFUSION OVER GASOLINE: WHERE ARE THE ENGINEERS?

by A. J. Fritsch

Center for Science in the Public Interest

1972 5p
Report no. SAE-720460

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Industrial practices can cause consumer confusion. The failure to communicate between the highest levels of automotive and petroleum companies provides an example. Gasoline is taken for granted by the driving public. It is extremely toxic and its emission products are a major contributing factor to air pollution. Engineers know how automotive and gasoline problems are interlocked. The Clean Air Act has forced scientists and engineers to cooperate. Technological solutions and cleanup timetables are insurmountable only when this collaboration is missing. The substantiation of gasoline advertisements, trade secrecy, standardization, and lead consumption are also covered in this paper. To preserve a safe and pollution-free environment, the scientist and the engineer both have a duty to anticipate toxic and unsafe products and company practices.

5/6 Fuel Systems (Cont'd.)

HS-012 040 (Cont'd.)

Search terms: Automotive industry; Petroleum industry; Gasoline; Advertisements; Standardization; Corporate responsibility; Engineers; Leaded gasoline; Vehicle air pollution

AVAILABILITY: SAE

HS-012 060 Fld. 5/6

AUTOMOBILE EXHAUST EMISSIONS: BIBLIOGRAPHY

by F. S. White, comp.

Texas A. and M. Univ. Texas Transp. Inst.

1971 33p 134refs
Report no. PB-205-760

Sponsored by Texas Hwy. Dept. in cooperation with the Bureau of Public Roads.

An annotated, selective bibliography is presented. Coverage is limited to technical journals and reports. Subjects covered include vehicle air pollution, exhaust emissions and their control and measurement, evaporative emissions, evaporative emission control, exhaust emissions sampling, and crankcase emission control.

Search terms: Bibliographies; Exhaust emissions; Vehicle air pollution; Exhaust emission control devices; Evaporative emissions; Exhaust emissions measurement; Exhaust emission control; Evaporative emission control; Exhaust emissions sampling; Crankcase emission control; Exhaust composition; Air pollution emission factors

5/7 Glazing Materials

HS-012 022 Fld. 5/7

FURTHER DEVELOPMENT OF WINDSHIELDS AND WINDSHIELD MOUNTING

by U. W. Seiffert; C. Hildebrandt; W. Nitzsche

Volkswagenwerk A.G. (West Germany)

1972 9p 14refs
Report no. SAE-720355

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

The development of windshields and their methods of mounting are covered. By performing tests in which a single head form strikes against the windshield, two model heads strike against the windshield at the same time, and an unrestrained test dummy strikes the windshield, it has been shown that reinforcement of the interlayer and, at the same time, limiting of the windshield edge mounting would improve the safety factor when accidents occur. The necessity of further development is however dependent on the restraint system used. Apparently, development of the windshield is not necessary if inflatable restraint systems are used and if their performance is sufficient.

Search terms: Windshield design; Windshield mounting; Windshield impact tests; Windshield penetration; Pendulum tests; Head forms; Ambient temperatures; Impact velocity; Impact angle

AVAILABILITY: SAE

5/10 Lighting Systems

HS-011 999 Fld. 5/10; 3/4; 3/12

IMPROVEMENT OF VISIBILITY FOR NIGHT DRIVING

Published in *Highway Research Record* n377 p1-23 (1971)

24refs

Sponsored by Highway Research Board Committee on Visibility and presented at the 50th annual meeting.

The research documented in this report confirms that at night on rural highways most motorists overdrive their headlights. Studies conducted to determine visibility of various highway vision targets and the effect of various lighting configurations on driver performance are summarized. Means by which night visibility may be improved are discussed. It is concluded that a polarized headlighting system is the most promising system likely to solve the night visibility problem; the system is technically and economically feasible in regard to today's vehicle population; the system would be advantageous in terms of improved visibility with less glare for motorists; and the results of the use of such a system would be increased vehicular control, safety, and comfort and probably improved traffic flow and utilization of highways at night.

Search terms: Night visibility; Rural highways; Headlamp design; Headlamp glare; Glare reduction; High beamed headlamps; Low beamed headlamps; Polarized headlamps; Driver fatigue; Driving simulation; Driver reaction distance; Highway lighting; Driver reaction time; Target detection; Driver performance under stress; Sight distances

HS-012 002 Fld. 5/10

CONTROLLING HEAD-LAMP AIM

by D. M. Finch

Published in *Highway Research Record* n377 p32-9 (1971)

Sponsored by Highway Research Board Committee on Visibility and presented at the 50th annual meeting.

The results of vehicle inspections in California and examination of a 20 vehicle test sample indicate that one-third to one-half of all vehicle headlamps are misaimed. Test results of 70 sealed beam headlamps show that nearly half of the newly installed headlamps fail to meet SAE aim requirements. A survey of headlamp housings revealed inherently unstable design and construction features which probably contribute to the problems of controlling headlamp aim. Photometric tests performed on 165 sealed beam headlamp units available on the open market resulted in 64% failure to meet the specifications. Of those that failed, however, about two-thirds could meet the photometric requirements if the aiming plane were shifted to some position other than that specified for the test. This indicates that the aiming plane is in many cases not being established with sufficient accuracy in production, and as a consequence even a correctly aimed headlamp may not produce an acceptable beam pattern on the roadway.

Search terms: Headlamp aiming; Sealed beam headlamps; Headlamp tests; Headlamp standards; Headlamp design; Headlamp alignment; Lamp housings; Photometry; California

HS-012 003 Fld. 5/10; 5/3

EFFECT OF DAYTIME USE OF MOTORCYCLE HEADLIGHTS AND TAILLIGHTS ON MOTORCYCLE NOTICEABILITY

by A. Cassel; M. S. Janoff

Published in *Highway Research Record* n377 p40-52 (1971)

27refs

Sponsored by Highway Research Board Committee on Visibility and presented at the 50th annual meeting.

Four front and three rear-light experiments were conducted. The front-light experiments evaluated motorcycle headlights and amber running lights under different traffic conditions. The rear-light experiments evaluated standard motorcycle taillight and brake light, raised high-intensity taillight with contrasting background, and dual raised red and amber taillights for two different traffic situations. The results indicate that daytime use of headlights significantly increases noticeability of the motorcycle by other motorists. However, the relative effectiveness of the headlight is substantially greater in cloudy weather. Use of front amber running lights increases noticeability about half as much as the headlight. The rear-light experiments indicate that red motorcycle taillights, number of lights, mounting height, and contrasting background do not significantly increase motorcycle noticeability during the daytime. However, dual amber taillights were found to improve noticeability similar to the front running lights.

Search terms: Motorcycle visibility; Headlamp daytime usage; Taillamp daytime usage; Amber taillamps; Low beamed headlamps; High beamed headlamps; Helmets; Running lamp daytime usage; Red lamps; Weather

HS-012 006 Fld. 5/10; 5/3

EFFECT OF DISTANCE AND MOTORCYCLE HEADLIGHT CONDITION ON MOTORCYCLE NOTICEABILITY

by M. S. Janoff; A. Cassel

Published in *Highway Research Record* n377 p64-8 (1971)

8refs

Sponsored by Highway Research Board Committee on Visibility and presented at the 50th annual meeting.

This paper describes the design and results of a set of motorcycle noticeability

experiments and differences in distances during daylight at which motorcycles with headlights on can be perceived by drivers as opposed to motorcycles with headlights off. The experimental design included two motorcycle headlight conditions—no light and high beam—and six distances ranging from 50 to 300 ft. from the opposing vehicle. The experiment was conducted in downtown Philadelphia. The results of this experiment indicate that, when a motorcycle operates during the daylight with a headlight, drivers of other vehicles will notice the motorcycle sooner and at greater distances.

Search terms: Motorcycle visibility; Headlamp daytime usage; High beamed headlamps; Sight distances

5/14 Occupant Protection

HS-011 993 Fld. 5/14; 3/2; 4/7

BIOMECHANICS OF RESTRAINT AND IMPACT ATTENUATION SYSTEMS

by V. L. Roberts; J. H. McElhaney

Michigan Univ. Hwy. Safety Res. Inst.

Published in *AGARD Conference Proceedings* n88 (AGARD-CP-88-71) 1971 pC2-(1-9)

17refs

Presented at the Aerospace Medical Panel Specialist Meeting, AGARD Conference on Linear Acceleration of Impact Type, Oporto, Portugal, 23-26 Jun 1971.

The criteria which should be used in the evaluation of passive restraints are provided. Impact sled tests and the HSRI Two-Dimensional Crash Victim Simulator used to define restraint system performance are discussed. The research indicates that a passive restraint system such as an air bag appears to be a promising development for occupant restraint;

HS-011 993 (Cont'd.)

the level of protection provided by a passive restraint system as measured by acceleration levels is equal to or better than a belt type restraint system; for human volunteer tests a lap belt plus a rapidly inflating passive restraint performed significantly better than a lap belt alone in terms of reduced head motion, linear head acceleration, shoulder motion, and neck pain; passive restraint performance at high energy levels—40 mph, 40 g—still shows promise although injury levels may be exceeded; and current human simulators require additional improvement in terms of their ability to reproduce neck motion.

Search terms: Biomechanics; Air bag restraint systems; Restraint system design; Restraint system tests; Restraint system effectiveness; Impact tests; Impact sleds; Anthropometric dummies; Occupant kinematics; Head acceleration tolerances; Mathematical models; Impact attenuation; Chest acceleration tolerances

HS-011 995 Fld. 5/14; 4/7

THE MATHEMATICS OF IMPACT, AND CRASH TESTS OF AIRPLANE AIRBAG RESTRAINT SYSTEMS

by C. C. Clark

Published in *AGARD Conference Proceedings n88* (AGARD-CP-88-71) 1971 pC1-(1-8)

9refs

Presented at the Aerospace Medical Panel Specialist Meeting, AGARD Conference on Linear Acceleration of Impact Type, Oporto, Portugal, 23-26 Jun 1971.

In impact tests it is desirable in interpreting the motions to measure positions

and velocities as well as accelerations, and relate all recordings to the six possible degrees of freedom of motion of each object element not rigidly bound in motion as part of another element. The mathematical accounting for all position, velocity, and acceleration changes, and measurements, requires a careful attention to axes and components. The representation of human acceleration environments by accelerometers filtered to be flat in response from 0 to 240 Hertz, then attenuated above 240 Hertz at 12 db per octave, is urged, in preference to the more common representation by AC accelerometers flat from perhaps 10 to 2000 Hertz, which often obscure biologically important accelerations in metal ringing spikes. Illustrations are drawn from the crash studies of airplane airbag restraint systems and from the mathematical representation of the passenger compartment loads for automobile crashes of various types.

Search terms: Impact tests; Biodynamics; Mathematical models; Impact velocity; Acceleration; Accelerometers; Degrees of freedom; Air bag restraint systems; Impact forces; Restraint system tests; Aircraft safety; Vehicle kinematics; Occupant Kinematics; Collision models

HS-012 015 Fld. 5/14

THE WAY FORWARD FOR CAR SAFETY

by I. D. Neilson

Published in *Autocar* v136 n3972 p6-9 (1 Jun 1972)

Improvement of vehicle primary safety features to reduce the chance of accidents occurring is seen to be an important though perhaps limited way forward for road safety. The secondary safety approach involves protection of vehicle occupants during accidents. Secondary safety features are seen to have great potential in reducing accident injuries and fatalities. The relative merits of seat belts, interior padding, and air bag re-

straint systems are briefly discussed. Projected trends in the design of small European cars for the future are presented.

Search terms: Automobile safety characteristics; Automobile design; Occupant protection; Injury prevention; Seat belts; Air bag restraint systems; Seat belt usage; Padding; European vehicles; Safety design

HS-012 033 Fld. 5/14; 1/2

HUMAN TRANSPORTATION FATALITIES AND PROTECTION AGAINST REAR AND SIDE CRASH LOADS BY THE AIRSTOP RESTRAINT

by C. Clark; C. Blechschmidt

Martin Co.

Published in *Stapp Car Crash Conference (9th) Proceedings*, Minneapolis, 1966 p19-64

51refs

The multiple origins of airbag restraint concepts are traced. Analytical models of automobile crash loads, and of passenger motions in the airstop restraint, consisting of a chest airbag and an inflated airseat, are reviewed, with emphasis on rear and side collisions. A lateral crash protection door structure with a lateral bumper to prevent penetration, improved padding, and a transparent airbag inflated upwards over the windows is suggested. Other features of a safety car design are tabulated. The need for experimental data from automobile crashes with the airstop restraint is emphasized.

Search terms: Fatality rates; Trip length; Air bag restraint systems; Impact forces; Occupant kinematics; Seat belts; Side impact bars; Accident statistics; Side impact collisions; Rear end collisions; Whiplash injuries; Rural accidents; Safety cars; Inflatable seats; Acceleration; Secondary collisions; Accident types; Impact velocity; Experimental automobiles

HS-012 034 Fld. 5/14; 5/4

AUTO SAFETY NEEDS A NEW ROAD MAP

by W. Bowen

Published in *Fortune* v85 n4 p99-101, 142-5 (Apr 1972)

It is felt that in the preoccupation with crash survivability not enough research and money are going into other aspects of automobile safety. Automobile companies question whether development of the air bag is far enough along to warrant adoption for 1976 models. A one-year trial involving 20,000 cars might at least indicate how much additional testing is needed. The experimental safety vehicle is briefly discussed. Other aspects of safety for which more attention is urged are elimination of roadside hazards, control of drunk drivers, better vehicle lighting, and driver aid systems.

Search terms: Air bag restraint systems; Seat belts; Shoulder harnesses; Safety cars; Automobile safety characteristics; Drinking drivers; Vehicle lighting; Automobile safety standards; Crashworthiness; Accident survivability; Highway safety programs; Federal role; Occupant protection; Passive restraint systems; Experimental automobiles; Roadside hazards; Alcohol usage deterrents; Driver aid systems

HS-012 036 Fld. 5/14

A PASSIVE SAFETY BELT SYSTEM

by S. Pilhall; N. Bohlin

Volvo A.B. (Sweden)

1972 8p 3refs
Report no. SAE-720440

Presented at 2nd International Conference On Passive Restraints, Detroit, 22-25 May 1972.

The geometry and behavior of several front-seat passive belt configurations have been studied and evaluated. General design criteria are discussed. The preferred solution is a three-point belt with two ends attached to the door. The belt straps automatically, and for comfortable exit, the occupant may make a slight manual operation. Crash tests indicate that the belt performs approximately as a standard three-point belt. Door strength, retractor strength, strap strength and tension, seat influence, etc., have been tested. Curves are given for recorded and computed data, including old and new severity index.

Search terms: Seat belt design; Three point restraint systems; Seat belt tests; Automatic seat belts; Injury severity index; Impact tests

AVAILABILITY SAE

HS-820 220 Fld. 5/14; 4/7

ANALYSIS OF DECELERATOR, ACCELERATOR AND SHOCK CORD PROPELLED REBOUND SLEDS FOR EVALUATING AIR BAG RESTRAINTS. FINAL REPORT

by A. K. Johnson

National Hwy. Traf. Safety Administration

1972 37p

In contrast to a decelerator sled which comes to rest, accelerator and shock cord propelled, impact-with-rebound sleds may decelerate immediately post-impact. The analysis of the deceleration immediately post-impact for a subject restrained only by an air bag establishes that the distance the subject translates forward in the seat is less, and his rebound velocity against the seat is greater, than if he has been riding a decelerator sled. For a specific set of air bag and impact characteristics, the results of mathematical models developed for this analysis indicate that the increase in re-

bound velocity for the accelerator can be 20% greater and for the impact-with-rebound sled 100% greater than if the subject were riding a decelerator sled. It is concluded that a decelerator sled is a much better simulator of a vehicle crash into a barrier than an accelerator or shock cord propelled, rebound sled.

Search terms: Impact sleds; Mathematical models; Rebound; Air bag restraint systems; Impact velocity; Restraint system tests; Barrier collision tests; Simulation models; Propulsion systems; Crash response forecasting; Occupant kinematics; Time factors; Occupant modeling; Impact forces

AVAILABILITY: NHTSA

5/18 Steering Control System

HS-012 023 Fld. 5/18; 4/7

FRICTION AND THE MECHANICS OF SKIDDING AUTOMOBILES

by R. M. Brach

Published in *Highway Research Record* n376 p99-106 (1971)

12refs

Sponsored by Highway Research Board Committee on Surface Properties-Vehicle Interaction.

This paper shows that the differential equation of motion of a skidding automobile can be integrated even when variable friction is included. An exact algebraic expression for the skidding distance is obtained in terms of the initial speed, weight distribution, and friction characteristics of the vehicle. This exact expression is examined from three points of view. It is used to explain how the improper use of a constant, average friction value can lead to biased results. It is shown that actual, variable friction curves can be found by using curve-fitting techniques with rather simple

5/18 Steering Control System (Cont'd.)

HS-012 023 (Cont'd.)

experimental data. The exact expression is used from the point of view of accident investigation to show that the initial speed of a skidding automobile under very general vehicle-tire-road conditions can be read from a single graph.

Search terms: Equations of motion; Stopping distance; Coefficient of friction; Friction studies; Mathematical models; Skidding; Wheel locking friction; speed

HS-012 048 Fld. 5/18

A NEW LABORATORY FACILITY FOR MEASURING VEHICLE PARAMETERS AFFECTING UNDERSTEER AND BRAKE STEER

by A. L. Nedley; W. J. Wilson

General Motors Corp.

1972 20p 7refs

Report no. SAE-720473

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

A new laboratory test facility for measuring the various understeer influences on complete vehicles is described. The machine actuates the body and suspension in the same manner as it occurs on the road while turning or braking. Changes in steer and camber angles of the wheels are measured as body roll, tire lateral forces, and tire aligning torques are applied to the vehicle separately or simultaneously. It makes a direct measurement of vehicle roll susceptibility (tendency to roll in a turn). Steer caused by braking, called brake steer, is measured by applying brake forces. A description is given of the systems and interacting subsystems of the machine,

which provide duplication of a wide range of actual over-the-road conditions while preventing application of unrealistic constraints to the vehicle. Design features that create the capability to obtain the desired accuracies while minimizing test time are also discussed.

Search terms: Test facilities; Test equipment; Automobile tests; Understeer; Roll; Camber; Steering; Tire forces; Lateral force; Tire moments; Torque; Weight distribution; Sideslip; Vehicle stability; Tire brake force; Braking forces; Brake steer

AVAILABILITY: SAE

5/22 Wheel Systems

HS-011 991 Fld. 5/22

ABRASION AND TRACTION STUDIES. NEW EYES ON TREAD WEAR

by B. B. Boonstra; F. A. Heckman; A. Kabaya

Published in *Rubber Age*. v104 n4 p33-41 (Apr 1972)

5refs

Based on a paper presented at 99th Meeting, Div. of Rubber Chemistry, American Chemical Society, Miami Beach, 27-30 Apr 1971.

The purpose of the present study is to gain new knowledge about the relationship between abrasion and the coefficient of friction of rubber compounds. Laboratory experiments were conducted in which coefficient of friction, or rather braking force coefficient and abrasion loss, were measured and actual abraded surfaces were studied using photomicrography and the relatively new technique of scanning electron microscopy.

Search terms: Rubber compounds; Abrasion; Abrasion resistance; Coefficient of friction; Tire wear; Tire wear

measurement; Tire wear resistance; Scanning electron microscopes; Tire traction; Tire treads; Photo-micrography; Photomicrography; Laboratory tests

HS-012 004 Fld. 5/22

HIGHER ORDERS OF TIRE FORCE VARIATIONS AND THEIR SIGNIFICANCE

by W. K. Klamp; J. Meingast

Uniroyal, Inc.

1972 6p

Report no. SAE-720463

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

A number of tires have been examined in terms of the higher orders of radial and fore-and-aft force variations. Presented in this paper are some typical values of higher orders as measured on a specially designed high-speed machine. These measurements are related to the following factors: tire operating conditions, tire construction variations, influence of wheel and balance, radial force correction, and ride evaluation. With experience, emphasis has shifted to understanding how tire manufacturing introduces higher harmonic disturbances, thereby improving tire production and making better use of conventional uniformity grading equipment.

Search terms: Tire force measurement; Tire riding characteristics; Tire grading; Tire manufacture; Tire test equipment

AVAILABILITY: SAE

HS-012 019 Fld. 5/22

INTERACTION OF VEHICLE AND ROAD SURFACE

by D. L. Ivey; C. J. Keese; A. H. Neill, Jr.; C. Brenner

TESTING AND ANALYSIS OF TIRE HYDROPLANING

26refs

Sponsored by Highway Research Board Steering Committee for Workshop on Anti-Skid Program Management.

The origins of skid-initiated accidents cannot be studied effectively without considering the interaction of the automobile, the highway, and the driver and their relationship to the total environment. Because vehicle characteristics are susceptible to and have undergone rapid change compared to roadway conditions, there exists today a mismatch between many vehicles using the roadways and the roadway system. Because the capabilities of drivers vary so widely, there is also a mismatch between the capabilities of many drivers and the functions they are required to perform to drive safely. A deterioration in any one of the three major factors can produce such a mismatch. Elimination of these mismatches should be a primary goal of any anti-skid program. An accurate simulation of the vehicle-pavement system that will reflect the interaction of variables during vehicle maneuvers is critically needed.

Search terms: Tire road contact forces; Vehicle road interface; Driver vehicle road interfaces; Acceleration; Deceleration; Cornering; Tire traction; Skidding; Pavement friction; Braking; Pavement surface texture; Wet road conditions; Tire pavement interface; Pavement skid resistance; Tire slip motion

by R. W. Yeager; J. L. Tuttle

Goodyear Tire and Rubber Co.

1972 13p 7refs
Report no. SAE-720471

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

The ability to view the tire footprint and simultaneously to measure the tire-to-road surface interface forces is essential to the investigation of parameters affecting high-speed passenger tire performance on wet surfaces. The tire is photographed from below through a glass plate; the tire-to-road surface interface forces are recorded for various combinations of tire types, inflations, loads, wear conditions, water depth, and vehicle velocity as the tire passes over a triaxial force pin. The facility and test method are described for the evaluation of pneumatic tires at all modes of operation. An empirical equation is given to estimate the hydroplaning speed of a passenger tire on a smooth surface in a single mode (free rolling) of operation. The parameters that affect tire hydroplaning are discussed as are some of the conditions that may influence the method of test. Implication is made that these factors and parameters also are related to high-speed wet surface braking distance.

Search terms: Tire road contact forces; Hydroplaning; Wet road conditions; Tire force measurement; Tire inflation pressure; Tire treads; Fluid flow; Water depth; Tire loads; Test equipment; Tire pavement interface; Pneumatic tires; Tire tests; Pavement surface tex-

AVAILABILITY: SAE

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DESIGN OF LABORATORY EQUIPMENT FOR ROUTINE TIRE FORCE AND MOMENT TESTING

by T. E. Ritter; W. S. Kristofetz; A. D. Cortese; R. E. Rasmussen

General Motors Proving Ground

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Tire force and moment test machines are used to measure mechanical properties important to vehicle handling. Many different machines have been developed for this type of work. This report discusses considerations in the design of such equipment which include productivity, road simulation, tire size range, input parameters, weighing system design, and data processing. The design of a new test machine with a belt type road simulator is described. Some early test data on machine correlation, lateral force and aligning torque dynamics, and flat road uniformity are presented.

Search terms: Tire tests; Tire test equipment; Tire force measurement; Tire forces; Tire moments; Road simulators; Data processing; Computerized test methods; Tire characteristics

AVAILABILITY: SAE

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